In the United States Court of Federal Claims

OFFICE OF SPECIAL MASTERS

No. 16-994V

(Not to be published)

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NICHOLAS ZUMWALT, *on behalf of his minor child, L.Z.*, Petitioner, v. SECRETARY OF HEALTH AND HUMAN SERVICES, Respondent.	Special Master Corcoran Filed: March 21, 2019 Tetanus-Diphtheria-Acellular Pertussis Vaccine; Seizure Disorder; *Althen* Prong One; Treating Doctor Opinion; *Althen* Prong Two.
* *	

Andrew D. Downing, Van Cott & Talamante, Phoenix, AZ, for Petitioner.

Ryan D. Pyles, U.S. Dep't of Justice, Washington, DC, for Respondent.

ENTITLEMENT DECISION[1]

Nicholas Zumwalt, as legal representative of his minor child, L.Z., filed a petition on August 12, 2016, seeking compensation under the National Vaccine Injury Compensation Program ("Vaccine Program").[2] Pet. at 1 (ECF No. 1). Mr. Zumwalt alleged that L.Z.'s seizure disorder was caused by some or all of the following vaccines administered on March 24, 2014: Prevnar 13 (pneumococcal), Pediarix (polio, hepatitis B, and diphtheria-tetanus-acellular pertussis ("DTaP")),

[1] Although this Decision has been formally designated "not to be published," it will nevertheless be posted on the Court of Federal Claims' website in accordance with the E-Government Act of 2002, 44 U.S.C. § 3501 (2012). **This means that the Decision will be available to anyone with access to the internet.** As provided by 42 U.S.C. § 300aa-12(d)(4)(B), however, the parties may object to the Decision's inclusion of certain kinds of confidential information. Specifically, under Vaccine Rule 18(b), each party has fourteen days within which to request redaction "of any information furnished by that party: (1) that is a trade secret or commercial or financial in substance and is privileged or confidential; or (2) that includes medical files or similar files, the disclosure of which would constitute a clearly unwarranted invasion of privacy." Vaccine Rule 18(b). Otherwise, the whole decision will be available to the public in its current form. *Id.*

[2] The Vaccine Program comprises Part 2 of the National Childhood Vaccine Injury Act of 1986, 42 U.S.C. §§ 300aa-10–37 (2012) (hereinafter "Vaccine Act" or "the Act"). Individual section references hereafter shall refer to § 300aa of the Act.

ActHib 4 (Haemophilus influenzae type B) ("Hib"), and RotaTeq (rotavirus). *Id.*

An entitlement hearing was held in this matter on October 9, 2018. After consideration of the record and testimony provided at hearing, I find that Petitioner is not entitled to a compensation award. As discussed in more detail below, Petitioner has not set forth a reliable theory explaining how any of the vaccines L.Z. received on March 24, 2014, could have caused his injuries.

I. Factual Background

Pre-Vaccination History

L.Z. was born premature at almost thirty-six weeks on September 24, 2013. Ex. 21 at 4, filed Nov 3, 2016 (ECF Nos. 11-3–11-4). He spent his first six days in the neonatal intensive care unit due to a high heart rate at birth, which was ultimately diagnosed as supraventricular tachycardia.[3] *Id.* His heart rate decreased after cardioversion,[4] and he was prescribed medication to help him maintain a normal heart rate thereafter. *Id.* at 5.

At his one-month well-child visit with Geeta Silas, M.D., L.Z. seemed to be in good health. *See* Ex. 3 at 72–75, filed Aug. 23, 2016 (ECF No. 5-3). The only concern noted was a rash near his urethral opening, and Dr. Silas recommended he continue to receive heart rate medication prophylactically. *Id.* at 74–75. L.Z.'s two-month check-up was similarly unremarkable. *Id.* at 67–71. He received his two-month vaccinations without incident, and Dr. Silas deemed his development to be appropriate for his age in all areas, although he continued to receive heart rate medication. *Id.* at 67, 70–71.

While L.Z.'s overall physical health at his four-month well-child check-up appeared good, Dr. Silas began to express concerns about his development. *See* Ex. 3 at 61–66. Specifically, she noted delays in his social interaction and eye contact, which she found to be "inconsistent for age." *Id.* at 61. He passed eight of the twelve developmental milestones assessed at this visit but failed to visually track objects beyond the midline, bring a toy to his mouth while in a supine position, orient to a voice, or laugh out loud. *Id.* at 62. She also noted that L.Z. would frequently spit up, indicating reflux. *Id.* at 61. Dr. Silas prescribed Zantac (ranitidine) for L.Z.'s reflux and continued digoxin for his heart. *Id.* at 65. He received his four-month vaccinations, again without incident. *Id.* at 65.

On March 24, 2014, L.Z. presented for his six-month check-up with Dr. Silas. Ex. 3 at 55–59. At this visit, Dr. Silas expressed additional concerns about his development. *See id.* In

[3] Supraventricular tachycardia is an elevated heart rate, specifically occurring where contraction begins above the heart's ventricles. *Dorland's Illustrated Medical Dictionary* 1867–68 (32nd ed. 2012) (hereinafter "*Dorland's*").

[4] Cardioversion is an electric shock given to restore the normal heart rate. *Dorland's* at 295.

particular, she identified increased tone in his lower extremities, head lag, problems with eye contact, and that he held his hands in tight fists.[5] *Id.* at 57. She noted in the relevant medical record "slight delay!!" and "inappropriate interaction" with regard to his neurological and psychiatric systems, and he failed two of the twelve six-month developmental milestones: reaching for and raking at objects, and transferring objects hand to hand (by five months of age). *Id.* at 56–57. Based upon these developmental concerns, Dr. Silas referred L.Z.'s parents to Laura Taylor, D.O., a pediatric development specialist, and to the Oklahoma "SoonerStart" Early Intervention center.[6] *Id.* at 58–59.

Vaccinations and Alleged Reaction

L.Z. received his six-month vaccinations at the March 24, 2014 visit with Dr. Silas: ActHib 4 and Prevnar 13 in his left shoulder, Pediarix in his right shoulder, and RotaTeq orally. Ex. 3 at 58. He did not experience any sort of reaction immediately after receiving the vaccines. Tr. at 7. On March 28, 2014—four days after vaccination, but prior to L.Z.'s alleged reaction—he was evaluated to determine eligibility for the early intervention services recommended by Dr. Silas. *See generally* Ex. 12. Evaluators determined that L.Z. was eligible for such services based on "delays (significant) . . . in adaptive, fine motor, and cognitive skills." *Id.* at 3. L.Z. did not pass the vision screening exam, and he was referred for a follow-up hearing appointment. *Id.* at 1.

Despite the above developmental concerns documented in the record, Petitioner has stated that he and Mrs. Zumwalt did not find L.Z.'s developmental delays to be of great concern, as they perceived L.Z.'s development overall to be largely normal. *See* Ex. 1 at 1, filed Aug. 23, 2016 (ECF No. 5-1) ("Pet. Aff."). Thus, Petitioner alleged that prior to his alleged vaccine reaction, L.Z. ate and slept well, rolled over, smiled, laughed, and sucked his fists. *Id.* at 1. To the extent that the Zumwalts did observe developmental delays, L.Z.'s parents attributed them to his prematurity. *Id.*

According to Petitioner's observations, L.Z.'s health began to decline sharply late in the evening of April 1, 2014, eight days after the relevant vaccinations. Pet. Aff. at 1; Tr. at 7–8. L.Z. did not rouse himself from his evening nap as he usually would, and when Mr. Zumwalt went to wake him, he appeared limp, pale, and unresponsive. Pet. Aff. at 1; Tr. at 8. Petitioner unsuccessfully attempted to elicit a response to various stimuli, including pain, his bottle, and being bathed. Tr. at 8–9. There is no record evidence for the period between the March 24th vaccinations and the evening of April 1st establishing any other related symptoms, however, and none are alleged.

[5] While the medical records from this March 24, 2014 visit do not specifically discuss the significance of L.Z. making tight fists, both of Petitioner's experts testified at hearing that this could be indicative of a neurological condition. Tr. at 54, 110.

[6] Based on the records filed in this case, SoonerStart appears to be a multidisciplinary care center that evaluates children for developmental delays and provides care and assistance to such children. *See generally* Ex. 12, filed Aug. 23, 2016 (ECF No. 6-3).

Concerned by L.Z.'s demeanor and failure to respond to stimuli, the Zumwalts brought L.Z. to the pediatric emergency room ("ER") at St. Francis Hospital in Tulsa, Oklahoma, on the night of April 1, 2014. Pet. Aff. at 2. Petitioner reported that ER treaters observed L.Z. experiencing seizure-like activity, and accordingly ordered a computerized tomography ("CT") scan of his head. *Id.* L.Z. was given anti-seizure medication which seemed effective. Ex. 11 at 45, filed Aug. 23, 2016 (ECF Nos. 6-1–6-2). The CT scan was conducted and revealed no acute intracranial abnormalities. Ex. 22 at 2464, filed Nov. 18, 2016 (ECF Nos. 13-1–13-10). L.Z. had no fever associated with this initial seizure onset. *Id.* at 2522.

The next evening (April 2, 2014),[7] L.Z. was admitted to St. Francis in status epilepticus, with right lip smacking and right clonic arm movement. Ex. 22 at 2522. At the time of this admission, treaters now noted a low-grade fever. *Id.* He was initially seen on the general pediatric floor but was soon transferred to the pediatric intensive care unit. *Id.* A head CT scan on the day of his admission was abnormal, showing asymmetry with possible structural defects in the left frontoparietal region. Ex. 11 at 45–46. An overnight continuous study electroencephalogram ("EEG") the night of April 2nd was also abnormal, reflecting left hemispheric slowing with periodic lateralizing epileptiform activity over the left, but without seizures. *Id.* A brain magnetic resonance imaging ("MRI") conducted on April 4th, however, showed no evidence of structural, infectious, or hemorrhagic/ischemic injury and was "completely normal." *Id.* at 47. An initial lumbar puncture showed cerebrospinal fluid ("CSF") pleocytosis[8] of 256 white blood cells. Ex. 22 at 1339. A repeat lumbar puncture performed soon thereafter, however, showed markedly reduced (and hence less concerning) pleocytosis, with the count now down to 14 white blood cells. *Id.*

L.Z. was discharged on April 17, 2014. Ex. 22 at 1923. At this time, he was prescribed phenobarbital to control his seizures, Prevacid to control reflux, acyclovir for possible viral infections, and additional anti-seizure medication. *Id.* at 1926. However, L.Z. suffered another seizure ten days later on April 27, 2014, for which he returned to the St. Francis ER. *Id.* at 1321. His parents reported that L.Z. had showed marked improvement during his time at home (and there is no record evidence to the contrary), but then had begun to act strangely the evening of April 26th (no eye contact, not interactive). *Id.* at 1339. In the ER, L.Z. was treated with a variety of aggressive medications, including benzodiazepines, phenobarbital, and Keppra, but his seizing continued, and he was subsequently placed in a pentobarbital-induced coma on April 29th. *Id.* at

[7] It is unclear from the record whether L.Z. was discharged from the St. Francis pediatric ER and returned to the hospital less than one day later, or whether he was simply transferred internally to another department. *Compare* Pet. Aff. at 2 (describing ER admission on evening of April 1 and stating that L.Z. was "admitted to the hospital for additional tests" after CT scan and not discharged until April 17, 2014) *with* Ex. 22 at 2522 (April 2nd admit/transfer note stating that L.Z. had a seizure twenty-four hours earlier, "was evaluated in another emergency department and then sent home").

[8] Pleocytosis is characterized by the presence of a higher number of white blood cells in the CSF than usual. *Dorland's* at 1460. Both parties' experts agreed that pleocytosis is evidence of an existing inflammatory process. Tr. at 101, 162.

1321, 1341. A May 6th MRI showed decreased brain volume since his previous MRI on April 4th. Ex. 22 at 1677. L.Z. was transferred to Cook Children's Hospital in Fort Worth, Texas, on May 6th, where additional intense medication still failed to put a stop to his seizures. Ex. 13 at 426, filed Aug. 23, 2016 (ECF Nos. 6-4–6-5).

On May 14, 2014, L.Z. was transferred back to St. Francis. Pet. Aff. at 2. A twenty-four-hour video EEG was conducted from May 25th–26th. Ex. 22 at 1163. The exam showed frequent electrographic seizures, centralized background slowing with right hemispheric asymmetric slowing, and frequent multifocal epileptiform discharges, but no clinical seizures. *Id.* at 1163–64. L.Z.'s treating pediatric neurologist, David Siegler, M.D., (whose testimony at hearing is discussed in detail below) deemed these results consistent with a diagnosis of infantile epileptic encephalopathy. *Id.* at 1164. The records from this part of L.Z.'s medical history do not identify the March 2014 vaccinations as potentially causal.

L.Z.'s condition has not changed significantly since his discharge from St. Francis on May 25, 2014. Records from late July 2016 show that he is still profoundly disabled, nonverbal, dependent on a feeding tube, and has poor visual interaction. Ex. 23 at 11, filed Dec. 7, 2016 (ECF No. 14-1). According to his father, L.Z. requires constant care, suffers frequent seizures, is quadriplegic, and has experienced severe brain volume loss. Pet. Aff. at 3.

Elimination of Possible Etiologies

In June of 2014, Dr. Siegler informed the Zumwalts that the etiology of L.Z.'s condition might never be ascertained. Ex. 11 at 35. Nevertheless, over the months and years following L.Z.'s two initial hospitalizations, many possible explanations were considered but eliminated. At Cook Children's, for example, treaters speculated that L.Z. might have Alpers' disease[9] or a genetic disorder related to a POLG1 genetic mutation, but test results for both were ultimately negative. Ex. 11 at 170; Ex. 22 at 89, 1180. An initial fifty-gene epilepsy panel screening was also negative, meaning that it showed no known pathogenic genetic mutation. Ex. 13 at 134. And August 1, 2014 lab tests for autoimmune conditions that could have triggered encephalopathy revealed no causal autoantibodies. Ex. 10 at 1–2, filed Aug. 23, 2016 (ECF No. 5-10).

In January 2015, L.Z. was referred to neurologist Cynthia Keator, M.D., who opined that febrile induced refractory status epilepticus ("FIRES") was the most accurate characterization of his epileptic state, though she noted that the actual etiology of this condition was as yet unknown. Ex. 11 at 140. At a June 2015 visit, Dr. Keator again maintained that L.Z. likely had FIRES of unknown origin, though she also posited that his condition might be Aicardi-Goutières

[9] Alpers' disease is a rare disease found in young children that results from a nuclear gene mutation. *Dorland's* at 528. It presents with progressive mental deterioration, seizures, motor problems, liver failure, and premature death. *Id.*

syndrome.[10] Ex. 13 at 156.

Testing performed in July 2015 revealed no disease-causing mitochondrial mutation or disorder. Ex. 13 at 127. In October 2015, further genetic testing was conducted in the form of whole exome sequencing. Ex. 13 at 128. This revealed only that L.Z. carries a variant in his UPF3B gene. *Id.* His mother also carries this variant, and while it is associated with X-linked intellectual disability, Petitioner reached out on his own to Dr. Jozef Gecz, a geneticist at the University of Adelaide in Australia, who opined (based on Petitioner's questions) that this genetic variant was not likely the cause of L.Z.'s condition.[11] *Id.*; Ex. 48 at 4, filed Nov. 3, 2017 (ECF No. 31-2).

A year later (and after this case had been initiated), Dr. Siegler filed a report with the Vaccine Adverse Event Reporting System ("VAERS") on September 10, 2016, attributing L.Z.'s seizure onset to his March 24, 2014 vaccinations. Ex. 17 at 1–2, filed Sept. 20, 2016 (ECF No. 9-1). In the report, Dr. Siegler described L.Z.'s post-vaccination adverse event as "intermittent periods of tonic activity of upper and lower extremities with clonus noted in the left lower extremity." *Id.* at 2. He wrote that the adverse event resulted in both "prolongation of hospitalization" and "permanent disability." *Id.* at 3.

II. Witness Testimony

Nicholas Zumwalt

Mr. Zumwalt provided testimony at the hearing consistent with the contents of his affidavit. Tr. at 4–29. He holds a master's degree in nursing, works as a professor of nursing at the University of Tulsa, and is preparing to defend his Ph.D. in nursing, specializing in "parent knowledge and understanding of suffering in nonverbal children with special needs in a neurological injury." Tr. at 5.[12]

According to Mr. Zumwalt, L.Z. was born one month premature, but was developing normally until he received the vaccinations at issue. Tr. at 5–6. Prior to vaccination, he had achieved early developmental milestones such as rolling over and sucking his fists, and he was able to eat, sleep, and interact well for his age. *Id.* Significantly, immediately before and after receiving his six-month vaccinations, L.Z. had no fever or other apparent illness, and L.Z. had no

[10] Aicardi-Goutières syndrome is a neuroimmune disorder caused by genetic mutation. A. Takanohashi, et al., *Elevation of Proinflammatory Cytokines in Patients wth Aicardi-Goutières Syndrome*, 80 Neurology 997, 997 (2013), filed as Ex. A Tab 2, Oct. 27, 2017 (ECF No. 29-2).

[11] Although Dr. Gecz's statement was obtained by Petitioner without the process of a formal evaluation of the sort that might characterize a treater opinion, neither party contends that the UPF3B genetic variant caused L.Z.'s seizures, and his view remains unrebutted.

[12] Although he testified as a fact witness in his capacity as L.Z.'s parent, Mr. Zumwalt's statements were exceptionally detailed and precise, largely due to his own professional experience in the medical field.

other immediate or identifiable reaction to the vaccinations. *Id.* at 6–7.

The evening of April 1, 2014, was "when things changed," as Mr. Zumwalt described. Tr. at 8. After L.Z. went down for his evening nap, he did not rouse himself as he usually would, and was lethargic and unresponsive when Petitioner attempted to wake him. *Id.* He also did not respond to direct stimuli. *Id.* at 8–9. The Zumwalts took him to the ER late that evening, concerned by his general appearance and his abnormal skin and breathing. *Id.* at 9.

Petitioner described the events of L.Z.'s first ER visit in a manner consistent with what is reflected in records from that visit, including L.Z.'s unremarkable CT scan, the series of medications administered throughout the day on April 2, 2014, before his seizures stopped that evening, and his two weeks of hospitalization for monitoring and further treatment. *See* Tr. at 9–13. Mr. Zumwalt had informed ER treaters that L.Z. had received several vaccinations one week prior, and recalled that no treater commented on whether they believed his son's condition to be vaccine-related. *Id.* at 11–12. L.Z. was discharged on prophylactic phenobarbital and acyclovir on April 17th, and by this time, Mr. Zumwalt recalled, his son's condition had improved significantly: "we had our smiling baby, happy baby, cuddly baby back." *Id.* at 13. He remained in this improved condition for nine days. *Id.*

Mr. Zumwalt next described how L.Z. began seizing again on April 26, 2014. Tr. at 13. At the ER, L.Z. was heavily medicated in an attempt to break his seizures. *Id.* at 14. Petitioner described the details of this ER visit and subsequent hospitalization in a manner consistent with the medical records, recalling that L.Z. was placed in a medically-induced coma for one week, that treaters later erroneously suspected L.Z. had a rare and fatal mitochondrial disorder known as Alpers' disease, and that L.Z. was ultimately discharged without a known etiology for his condition. *Id.* at 14–17. In the years since, no specific cause for L.Z.'s seizures has been identified, despite extensive testing for infectious causes, autoimmune antibodies, and whole exome sequencing. *Id.* at 17–18.

Petitioner concluded his direct examination testimony by describing L.Z.'s current condition. Tr. at 19–22. L.Z. is a quadriplegic, takes food and medication through a tube, cannot speak, frequently suffers bouts of pneumonia, has kyphosis and scoliosis, and must receive oxygen through a breathing tube at all times. *Id.*

During a brief cross-examination, Mr. Zumwalt was questioned about L.Z.'s pre-vaccination referral to SoonerStart based upon developmental concerns. Tr. at 24–26. Petitioner did not recall the specific basis for that referral, but characterized any concerns treaters may have had as minor, opining that such an evaluation was simply suggested "out of caution." *Id.*

Dr. David Siegler

Dr. Siegler testified at hearing on Petitioner's behalf and filed one sixteen-page report. Tr. at 30–65; Ex. 24, filed May 5, 2017 (ECF No. 20-1) ("Siegler Rep."). Dr. Siegler is a pediatric neurologist with a practice based in Tulsa, Oklahoma, and he has served as L.Z.'s treating neurologist since April 3, 2014. Tr. at 31, 33. He testified in this case primarily as a fact witness, describing his own observations of L.Z.'s clinical course, but also offering an opinion about the causal role of vaccines in L.Z.'s disorder.

As reflected in his curriculum vitae ("CV"), Dr. Siegler received his B.S. at Stanford University, followed by his M.D. from the University of Texas Southwestern Medical School in Dallas. Ex. 62 at 5, filed Sept. 17, 2018 (ECF No. 52-1) ("Siegler CV"); Tr. at 31. He completed an internship and residency in pediatrics, followed by a residency in child neurology, all at Stanford. Siegler CV at 4. He is board-certified in pediatric neurology, and currently teaches at both the University of Oklahoma and Oklahoma State University, while being on staff at two hospitals in Tulsa. Tr. at 32; Siegler CV at 3. He also runs a solo practice, Child Neurology of Tulsa. Siegler CV at 1. Much of Dr. Siegler's practice involves working with patients with epilepsy, and he spends a significant amount of time reviewing EEGs. Tr. at 32.

Dr. Siegler provided both an overview of L.Z.'s clinical course and an opinion about the cause of his injury. Based on his experience as L.Z.'s treating neurologist, he opined that L.Z. developed encephalitis and afebrile status epilepticus as a result of a neurologic inflammatory cascade triggered by the vaccinations he had received eight days prior, and that this status epilepticus brought about his ultimate catastrophic brain injury. Tr. at 43–44; Siegler Rep. at 15–16. He based this both on his review of L.Z.'s test results and on the short time period between vaccination and onset. Tr. at 41; Siegler Rep. at 15. While he did not discuss a mechanism of causation in detail, he posited in his report that one of the vaccines L.Z. received on March 24, 2014, "could have induced an inflammatory cascade that culminated in his irreversible neurologic injuries." Siegler Rep. at 15.

Dr. Siegler dedicated most of his written report to a detailed overview of L.Z.'s history that was largely consistent with the medical record. *See* Siegler Rep. at 1–14. At hearing, Dr. Siegler began his testimony with a review of L.Z.'s first EEG on April 3, 2014, which showed left side epileptic activity. Tr. at 33–36. Dr. Siegler opined that L.Z.'s April 4th MRI reading, which was normal, coupled with his elevated white blood count, suggested the existence of an inflammatory event occurring at that time in L.Z.'s central nervous system. *Id.* at 36. Dr. Siegler also discussed the stark contrast between L.Z.'s April MRI and his May MRI, interpreting the decreased brain mass revealed in the May reading as evidence of ongoing diffuse brain atrophy. *Id.* at 39.

Dr. Siegler deemed the FIRES diagnosis mentioned by Dr. Keator to be inapplicable and

unhelpful to L.Z.'s case. Tr. at 40–41. By its own terms, FIRES necessarily requires that the patient have experienced a *febrile* illness, which L.Z. did not. *Id.* Furthermore, the term merely describes a set of symptoms, rather than propose a possible etiology of a patient's condition. *Id.*

During cross-examination, Dr. Siegler agreed that L.Z. had some developmental issues prior to vaccination (including visual tracking issues, head lag, and increased tone). Tr. at 52–54. While he acknowledged that some of these symptoms could indicate a preexisting neurological condition, he maintained that L.Z.'s pre-vaccination condition was so markedly different from afterward that he could not associate the former concerns with the latter, more alarming constellation of symptoms. *Id.* Dr. Siegler also acknowledged that, even though testing L.Z. received in September 2015 had not identified a possible genetic explanation for his seizure disorder, the list of identifiable genetic mutations associated with epilepsy has expanded in the past several years, and that he thus has no way of definitively knowing whether L.Z. may have a genetic mutation that contributed to his condition. *Id.* at 51.

When pressed about his basis for believing that vaccines caused the onset of L.Z.'s seizures, Dr. Siegler emphasized that he primarily based his opinion on the close temporal nexus between vaccination and seizure onset, along with the lack of an identified alternative cause. Tr. at 56.[13]

Dr. Lawrence Steinman

Lawrence Steinman, M.D., also testified and filed two reports on Petitioner's behalf. Tr. at 66–134; Ex. 26, filed July 18, 2017 (ECF No. 24-1) ("Steinman Rep."); Ex. 64, filed Nov. 12, 2018 (ECF No. 55-1) ("Steinman Supp. Rep.").[14] As shown in his CV, Dr. Steinman received his B.A. from Dartmouth College and his M.D. from Harvard Medical School, and he completed residencies in neurology and pediatrics at Stanford University. Ex. 27 at 1, filed July 18, 2017 (ECF No. 24-2) ("Steinman CV"). He has worked as a professor of neurology and pediatrics at Stanford for the past thirty-eight years, and during that time he has also worked as an attending physician at Stanford Children's Hospital. *Id.*; Tr. at 68–69. He has published over five hundred peer-reviewed publications on neurology and autoimmune disease. Steinman CV at 5–45; Tr. at 70. He has special expertise in the pertussis toxin, as thirteen of his numerous published articles specifically pertain to the interaction of pertussis and the immune system (although he has not

[13] Respondent also raised issues of Dr. Siegler's credibility during cross-examination. Specifically, Respondent's counsel questioned Dr. Siegler about his relationship with Petitioner's counsel and the timing of his VAERS report. Tr. at 47–49. Dr. Siegler acknowledged that he had previously been acquainted with Petitioner's counsel and had specifically recommended Mr. Downing to Petitioner. *Id.* at 47–48. He also acknowledged that he did not submit the VAERS report until September of 2016—well over two years after the onset of L.Z.'s brain injury—at which point he was aware that Petitioner was already pursuing litigation, although he explained that during the interim period he had been attempting to rule out other possible explanations. *Id.* at 48–49.

[14] The second of Dr. Steinman's two reports was filed one month *after* hearing, without Petitioner's counsel first seeking Respondent's consent or leave of the Court prior to filing.

written on the topic in many years), and he patented certain work related to the development of the acellular pertussis vaccine. Tr. at 74.

Dr. Steinman dedicated the majority of his testimony to attempting to explain how one or more of the vaccines L.Z. received on March 24, 2014, could have triggered the onset of his seizure disorder. He focused upon two in particular: RotaTeq and DTaP. Dr. Steinman noted that the RotaTeq package insert included a table showing a higher seizure incidence in patients who received the vaccine over those who received a placebo. Tr. at 81–82 (discussing Ex. 33 at 3, filed Aug. 2, 2017 (ECF No. 25-7)). Although he conceded that the difference between the reported seizure incidence rates was not statistically significant, Dr. Steinman nonetheless maintained that it was meaningful. *Id.* at 82–83. He did not attempt to explain a *mechanism* of causation for how RotaTeq could trigger a seizure, however.[15]

Next, Dr. Steinman turned to the DTaP vaccine, which he proposed could cause seizures in two different ways. First, he suggested that the vaccine's alum adjuvant (included in the vaccine to increase its immunogenicity) drives a cytokine response that could become pathogenic. Tr. at 84, 98–99. In his written report, Dr. Steinman stated that "alum acts in the inflammosome, a biochemical compartment within the cell associated with a broad spectrum of diseases including seizure disorders in infants." Steinman Rep. at 7. Certain cytokines are understood to induce fevers, which in turn can trigger seizures—though he acknowledged that this had little relevance to L.Z.'s case, as L.Z. did *not* experience a fever at the time of his initial hospitalization and first seizures (nor did he run a fever at the time of vaccination). *Id.* at 98–99. Dr. Steinman did not otherwise clearly explain the sequence of events, running from reaction to adjuvant to cytokine upregulation, that would ultimately result in the triggering of L.Z.'s seizures.

Dr. Steinman devoted far more time at hearing to discussing a second possible mechanism of causation involving the DTaP vaccine. In summary, he theorized that the pertussis toxin in the vaccine causes a specific kind of enzymatic activity, which in turn "kindle[s]" seizures. Steinman Rep. at 6; Tr. at 84–99. L.Z. received the TDaP vaccine, which contains acellular pertussis. Tr. at 88. The acellular pertussis component of the DTaP vaccine is intended to protect recipients against pertussis, an acute and contagious infection of the respiratory tract also known as whooping cough. *Dorland's* at 1421. Although formulated to contain lower amounts of pertussis toxin than its predecessor version,[16] the acellular pertussis vaccine, Dr. Steinman noted, still contains *some* pertussis toxin. In addition, the pertussis toxin (produced by the *Bordatella pertussis* bacterium) is not only a factor in causing pertussis itself, but has also been implicated, in the context of

[15] Dr. Steinman also noted in his written report (although he did not raise the contention at hearing) that the Hib vaccine's package insert reflected a possible association with post-vaccination seizures like RotaTeq. Steinman Rep. at 5–6.

[16] The newer "DTaP" vaccine that is more commonly administered today contains acellular pertussis, while the older "DTP" vaccine was formulated with whole cell pertussis.

vaccination, in pediatric neurological conditions (albeit primarily in connection to the whole cell form of the vaccine). S. Gomez, et al., *ADP-Ribosylation Activity in Pertussis Vaccines and its Relationship to the in vivo Histamine-Sensitisation Test*, 25 Vaccine 3311 (2007), filed as Ex. 61, Sept. 6, 2018 (ECF No. 51-10) ("Gomez")). The pertussis toxin is also specifically understood to play a role in ADP-ribosylation—an enzymatic protein modification process (occurring "post-translational," or after protein synthesis) important to cell signaling. Steinman Rep. at 7; K. Edwards, et al., *Pertussis Vaccines*, in "Plotkin's Vaccines" 713 (S. Plotkin, et al., eds., 7th ed. 2018); Tr. at 87–89 (citing Gomez).[17]

Gomez considered the efficacy of the most common test for measuring the degree of inactivation of detoxified pertussis toxin contained in the acellular form of DTaP: the histamine sensitization test ("HIST"), an *in vivo* testing process involving mice. Gomez at 3312. That test is a "lethal challenge" test,[18] in which the pertussis toxin the mice receive from vaccination sensitizes them to a subsequent anaphylactic shock instigated by histamine challenge. *Id.* at 3317. Because HIST is subject to variability and has been deemed unethical, a substitute test has been sought in the scientific/medical community. *Id.* at 3311–12.

To identify a possible substitute safety test, Gomez compared HIST results with a measurement of ADP-ribosylation enzyme activity in the same kinds of vaccines, reasoning that because this enzyme activity has been hypothesized as "directly responsible for the toxicity" measured by HIST, measuring it could be an alternative means of assessing vaccine safety. Gomez at 3311–12. Gomez's authors concluded that measuring ADP-ribosylation activity corresponded well to HIST results for DTaP containing genetically-detoxified pertussis toxin, but did not find a correlation between ADP-ribosylation activity results and HIST results for DTaP containing chemically-detoxified pertussis toxin (which is more commonly used in vaccines). *Id.* at 3317. The authors ultimately concluded that further evaluation was necessary to determine whether measuring ADP-ribosylation activity accurately reflects the pertussis toxicity level in DTaP. In Dr. Steinman's view, Gomez supported his contention that ADP-ribosylation occurs in the presence of the pertussis toxin, thus confirming that "the pertussis toxin activity is still [occurring] in the acellular vaccines." Tr. at 95–97 (discussing Gomez).

Dr. Steinman further maintained that the ADP-ribosylation enzymatic process is also integral to the triggering of seizures. In support of this, he cited two articles. The first posited that *when* seizures are occurring (albeit due to some other cause), the resulting neuronal cell death may

[17] Dr. Steinman also cited to four other articles published between 1988 and 1992 as confirming the relationship between pertussis toxin and neurologic injury, but at hearing conceded that *no* studies in the past twenty-seven years have confirmed the assertions of these earlier works. *See* Steinman Rep. at 6, 9; Tr. at 118–19.

[18] A lethal challenge test involves injection of animals with a particular vaccine, followed by inoculation some time later with a particular toxin that often results in the death of some of the animals. *See* Gomez at 3312; World Health Organization Department of Immunization, Vaccines and Biologicals, *Manual for Quality Control of Diphtheria, Tetanus and Pertussis Vaccines*, 26–27 (2013), https://www.who.int/biologicals/vaccines/pertussis/en.

be attributable in part to the presence of an enzymatic reaction involving poly(ADP-ribose) polymerase (or "PARP"). Steinman Rep. at 6 (citing L. Chi, et al., *Poly(ADP-Ribose) Signal in Seizures-Induced Neuron Death*, 71 Med. Hypotheses 283, 284–85 (2008), filed as Ex. 41, Sept. 6, 2018 (ECF No. 51-5) ("Chi")). The second suggested that inhibiting PARP decreased seizure activity. Tr. at 93 (citing S. Wang, et al., *Poly(ADP-Ribose) Polymerase Inhibitor Is Neuroprotective in Epileptic Rat Via Apoptosis-Inducing Factor and Akt Signaling*, 18 Molecular Neuroscience 1285 (2007), filed as Ex. 43, Sept. 6, 2018 (ECF No. 51-7) ("Wang")).

Wang describes an animal study in which seizures were induced with kainic acid[19] in order to evaluate the impact of seizure activity on activation of PARP in conjunction with a different substance (3-Aminobenzamide ("3-AB"), a benzoic acid derivative) known to have neuroprotective properties. Wang at 1285–86. Wang does not expressly equate the enzymatic process involving PARP with ADP-ribosylation, but Dr. Steinman seems to have concluded that the two are congruent. Tr. at 94 (characterizing PARP as "another member of this family of enzymes" that included ADP-ribosylase). Wang's authors concluded that 3-AB potentially could assist in the treatment of "hippocampal neuron demise caused by seizures," although the article did not discuss pertussis toxin or explain how it might produce seizures with associated neuronal damage. Wang at 1289. Dr. Steinman nevertheless maintained that Wang supported his contention that "excessive ADP ribosylation" stimulated by pertussis toxin could be neurologically harmful (because Wang established that suppression of PARP reduced neuronal harm). Steinman Rep. at 6; Tr. at 94–95.

Dr. Steinman also attempted to explain why the approximately eight-day timeframe between vaccine receipt and seizure onset was medically appropriate, citing Gomez in support. Tr. at 96–98. Gomez, he maintained, demonstrated that HIST testing conducted five days after vaccination of mice with pertussis toxin-containing vaccines revealed evidence of ADP-ribosylase activity within a day or more later—allowing him to opine that the seizure-inducing properties of that process could take seven or eight days total. *Id.* at 97–98; Gomez at 3313. In his one-page supplemental report, Dr. Steinman further asserted that the pertussis toxin could have a biologic effect in the body beyond five days. Steinman Supp. Rep. at 1 (citing J. Munoz, et al., *Biological Activities of Crystalline Pertussigen from Bordatella Pertussis*, 33 Infection & Immunity 820 (1981), filed as Ex. 65, filed Nov. 12, 2018 (ECF No. 56-1) ("Munoz")). Dr. Steinman otherwise confirmed, however, that he could cite no published medical literature in the past thirty years that had expressly hypothesized that ADP-ribsolyation *causes* seizure disorders in the context of vaccines, or that it does so in the timeframe proposed. Tr. at 118–19.

Dr. Steinman provided no additional evidence to explain how any of the vaccines L.Z. received, individually or in concert, could have caused a seizure disorder that would present

[19] Kainic acid is a potent, naturally-occurring neurotoxin found in some types of seaweed. C. Hammond, *Cellular and Molecular Neurophysiology* § 10.3 (4th ed. 2015).

without fever, and with no other pre-seizure indications of an ongoing immunological reaction. When questioned about how he could persuasively assert that L.Z.'s seizure disorder was caused by vaccination, Dr. Steinman placed great importance on the fact that no other potential cause had ever been identified. Tr. at 100. He did, however, emphasize his view that the pleocytosis noted from L.Z.'s CSF testing was "smoking gun" proof, because it established the existence of some inflammatory response at the time L.Z. first presented to the hospital. *Id.* at 101. He also admitted (when questioned on cross examination) that some of L.Z.'s pre-vaccination symptoms could be indicative of a neurologic condition, but added that such symptoms could "mean a lot of things" not necessarily connected to the post-vaccination seizure activity. *Id.* at 109–10.

Dr. John Zempel

John Zempel, M.D., Ph.D., was the only witness to appear on Respondent's behalf. He testified at hearing and submitted two written reports, maintaining that L.Z.'s vaccinations did not cause his seizure disorder. Tr. at 135–213; Ex. A, filed Oct. 24, 2017 (ECF No. 28-1) ("Zempel Rep."); Ex. C, filed Dec. 12, 2018 (ECF No. 64-1) ("Zempel Supp. Rep.").

As shown in his CV, Dr. Zempel received his B.S. from the University of Wisconsin-Madison, followed by his M.D. and Ph.D. (in neurobiology) from Washington University in St. Louis. Ex. B at 1, filed Oct. 24, 2017 (ECF No. 28-2) ("Zempel CV"). He completed residencies in pediatrics and child neurology, followed by fellowships in pediatric epilepsy and clinical neurophysiology. *Id.* at 2. He now teaches as a professor of neurology and pediatrics at Washington University School of Medicine, while also working half the year on inpatient services at multiple hospitals. *Id.* at 3; Tr. at 137. He estimated that his patient population is approximately 80% children with highly refractory epilepsy. Tr. at 138. Dr. Zempel is board-certified in neurology with a special qualification in child neurology, and he has published dozens of articles in medical and scientific journals, largely focusing on epilepsy and other EEG issues. *Id.* at 137; Zempel CV at 3, 5–8. He conceded, however, that his medical research does not directly involve vaccines or immunology. Tr. at 170–71.

In his hearing testimony and written report, Dr. Zempel made two overarching contentions: first, that L.Z. likely had some neurologic abnormality before his March 24, 2014 vaccinations; and second, that Dr. Steinman's theory of vaccine causation was unsupported by the medical literature upon which it relies. Tr. at 139–46, 148–52; 158–67; Zempel Rep. at 9–11.

Dr. Zempel began with a discussion of L.Z.'s development before vaccination, finding evidence of possible neurologic abnormalities even in his first months of life. Tr. at 139–46. He noted "subtle but persistent concern" from treaters about possible developmental delay, particularly with regard to his head lag, increased tone, poor visual interaction, and other motor skills. *Id.* at 139–41. L.Z.'s head growth had slowed between his two-month and six-month check-ups, which Dr. Zempel characterized as a concerning indication that L.Z.'s brain was failing to

develop at an appropriate pace. *Id.* at 142–44. Based on these documented concerns, Dr. Zempel concluded that there was "clear evidence" of neurologic abnormalities before L.Z. received his six-month vaccinations. *Id.* at 144–46. He conceded, however, that such evidence would not necessarily indicate a high epilepsy risk (and therefore was not necessarily predictive of the outcome L.Z. has experienced). *Id.* at 146–47.

Dr. Zempel next spoke about his assessment of L.Z.'s clinical course after vaccination and ultimate diagnosis. He agreed that L.Z. did not have FIRES (given the lack of fever), but stated that he may have experienced "new onset refractory status epilepticus" (or "NORSE"). Tr. at 154–55. He clarified that NORSE, like FIRES, is simply a descriptive term, and does not explain the condition's etiology. *Id.* at 157–58. He ultimately opined that the underlying cause of L.Z.'s epilepsy is as yet unknown, though he speculated that a yet-unidentified genetic component, infectious agent, or mitochondrial disease may have played a causal role. *Id.* at 148–52.

Dr. Zempel disagreed with Petitioner's experts' conclusion that vaccines may have played a role in triggering L.Z.'s seizure onset. Tr. at 158–60. He found Dr. Steinman's theory of causation too incoherent to analyze or respond to in full, criticizing Dr. Steinman's method of stringing together discrete scientific or medical concepts into a "causal stream." *Id.* at 168–69. In his report, Dr. Zempel noted a gap in Dr. Steinman's logic, stating that the medical literature cited by Dr. Steinman "does not demonstrate that detoxified pertussis vaccine actually plays a role in seizures and neuronal death, a key step in claiming causation." Zempel Rep. at 10. In so maintaining, Dr. Zempel disputed several of Dr. Steinman's interpretations of medical literature or other evidence. For example, he noted that while ADP-ribosylation could theoretically play a role in seizure activity, key literature cited by Dr. Steinman for this point (like Wang) said nothing at all about the seizure-inducing capacity of pertussis toxin. Tr. at 167.

Dr. Zempel also took issue with the contention that L.Z.'s medical records established the existence of an inflammatory event at the time of his hospitalization. Dr. Siegler read the change between L.Z.'s April and May MRIs as evidence that "the brain abnormalities are not secondary to status epilepticus but, rather, indicate[] a primary neuro-inflammatory destructive process." Siegler Rep. at 14. Dr. Zempel, by contrast, observed that the focal and global brain atrophy visible in the second MRI was common to refractory status epilepticus, and therefore did not actually corroborate the contention that L.Z. experienced a primary neuro-inflammatory destructive process. Zempel Rep. at 9. Rather, the decrease in brain mass between L.Z.'s April and May 2014 MRIs could be attributed to the seizures he experienced in the intervening weeks. *Id.*; Tr. at 163.

Ultimately, Dr. Zempel characterized L.Z.'s condition as idiopathic in origin. Tr. at 207. Most of the catastrophic status epilepticus cases he is familiar with never obtain an etiological explanation. Zempel Rep. at 10–11. Dr. Zempel clarified that he did not rely heavily on his observations about L.Z.'s possible pre-vaccination neurologic abnormality in reaching this

conclusion. Tr. at 211–12. At most, these early signs of abnormality were simply indicia that something else was going on. *Id.* He also admitted that L.Z.'s referral for developmental early intervention services may only have been prophylactic and/or due to his premature birth, but maintained that L.Z.'s demonstrated hypertonia and fisted hands were nonetheless indicia of pre-vaccination neurologic abnormality. *Id.* at 175–76.

In a two-page supplemental report filed in response to Dr. Steinman's post-hearing supplemental report, Dr. Zempel again criticized Dr. Steinman's reliance on medical literature not specific to the DTaP vaccine or pertussis toxin contained therein. Zempel Supp. Rep. at 1–2. Dr. Zempel also pointed out that Munoz (published in the early 1980s) spoke only to the effects of the *active* pertussis infection, not the impact of detoxified pertussis contained in the acellular DTaP vaccine. *Id.* at 2. Thus, "[m]erely showing that the actual pertussis toxin [. . .] has prolonged biological effects does not establish that the *inactivated* pertussis vaccine has any causal relationship to a seizure that occurred eight days after vaccination, well outside the temporal window demonstrated in epidemiological studies to be associated with seizures." *Id.* at 1–2 (emphasis added).

III. Procedural History

As previously noted, this matter commenced with the filing of the Petition and Petitioner's supporting affidavit on August 12, 2016. Over the following months, Petitioner filed medical records in support of his claim. Respondent thereafter filed a Rule 4(c) Report on February 15, 2017, asserting that compensation is not appropriate in this case. Petitioner subsequently filed a report from Dr. Siegler on May 5, 2017, followed by an expert report from Dr. Steinman on July 18, 2017. Respondent filed a responsive expert report on October 24, 2017. The parties filed their respective prehearing submissions over the summer of 2018, and a one-day hearing took place on October 9, 2018.

The parties elected not to file post-hearing briefs. Tr. at 215. However, on November 12, 2018, Petitioner filed an additional report from Dr. Steinman without first seeking leave of the Court or Respondent's consent. In the interest of fairness to the parties, I permitted Petitioner to file this report and gave Respondent the opportunity to submit a supplemental filing of his own. Respondent accordingly filed Dr. Zempel's supplemental report on December 12th. This case is now ripe for decision.

IV. Applicable Legal Standards

A. *Claimant's Burden in Vaccine Program Cases*

To receive compensation in the Vaccine Program, a petitioner must prove either: (1) that he suffered a "Table Injury"—i.e., an injury falling within the Vaccine Injury Table, corresponding

to one of the vaccinations in question and also occurring within a statutorily-prescribed period of time—or, in the alternative, (2) that his illnesses were actually caused by a vaccine (a "Non-Table Injury"). *See* Sections 13(a)(1)(A), 11(c)(1), and 14(a), as amended by 42 C.F.R. § 100.3; *see also Shalala v. Whitecotton*, 514 U.S. 268, 270 (1995) (quoting Section 11(c)(1)(C)(i)); *Moberly v. Sec'y of Health & Human Servs*., 592 F.3d 1315, 1321 (Fed. Cir. 2010); *Capizzano v. Sec'y of Health & Human Servs*., 440 F.3d 1317, 1320 (Fed. Cir. 2006).[20] Petitioner in this case asserts only a non-Table claim.

For both Table and Non-Table claims, Vaccine Program petitioners bear a "preponderance of the evidence" burden of proof. Section 13(1)(a). That is, a petitioner must offer evidence that leads the "trier of fact to believe that the existence of a fact is more probable than its nonexistence before [he] may find in favor of the party who has the burden to persuade the judge of the fact's existence." *Moberly*, 592 F.3d at 1322 n.2; *see also Snowbank Enter. v. United States*, 6 Cl. Ct. 476, 486 (1984) (mere conjecture or speculation is insufficient under a preponderance standard). A petitioner may not receive a Vaccine Program award based solely on his assertions; rather, the petition must be supported by either medical records or by the opinion of a competent physician. Section 13(a)(1).

For a non-Table claim, proof of medical certainty is not required. *Bunting v. Sec'y of Health & Human Servs*., 931 F.2d 867, 873 (Fed. Cir. 1991). In such circumstances, a petitioner must demonstrate that the vaccine was "not only [the] but-for cause of the injury but also a substantial factor in bringing about the injury." *Moberly*, 592 F.3d at 1321 (quoting *Shyface v. Sec'y of Health & Human Servs*., 165 F.3d 1344, 1352–53 (Fed. Cir. 1999)); *Pafford v. Sec'y of Health & Human Servs*., 451 F.3d 1352, 1355 (Fed. Cir. 2006). A petitioner asserting a non-Table claim must satisfy all three of the elements established by the Federal Circuit in *Althen v. Secretary of Health & Human Services*: "(1) a medical theory causally connecting the vaccination and the injury; (2) a logical sequence of cause and effect showing that the vaccination was the reason for the injury; and (3) a showing of a proximate temporal relationship between vaccination and injury." 418 F.3d 1274, 1278 (Fed. Cir. 2005).

Each of the *Althen* prongs requires a different showing. Under *Althen* prong one, petitioners must provide a "reputable medical theory," demonstrating that the vaccine received *can cause* the type of injury alleged. *Pafford*, 451 F.3d at 1355–56 (citations omitted). To satisfy this prong, the petitioner's theory must be based on a "sound and reliable medical or scientific explanation." *Knudsen v. Sec'y of Health & Human Servs.*, 35 F.3d 543, 548 (Fed. Cir. 1994). Such a theory must only be "legally probable, not medically or scientifically certain." *Id*. at 549.

[20] Decisions of special masters (some of which I reference in this ruling) constitute persuasive but not binding authority. *Hanlon v. Sec'y of Health & Human Servs.*, 40 Fed. Cl. 625, 630 (1998). By contrast, Federal Circuit rulings concerning legal issues are binding on special masters. *Guillory v. Sec'y of Health & Human Servs.*, 59 Fed. Cl. 121, 124 (2003), *aff'd*, 104 F. App'x 712 (Fed. Cir. 2004); *see also Spooner v. Sec'y of Health & Human Servs.*, No. 13-159V, 2014 WL 504728, at *7 n.12 (Fed. Cl. Spec. Mstr. Jan. 16, 2014).

Petitioners may satisfy the first *Althen* prong without resort to medical literature, epidemiological studies, demonstration of a specific mechanism, or a generally accepted medical theory. *Andreu v. Sec'y of Health & Human Servs.*, 569 F.3d 1367, 1378–79 (Fed. Cir. 2009) (citing *Capizzano*, 440 F.3d at 1325–26). Special masters, despite their expertise, are not empowered by statute to conclusively resolve what are essentially thorny scientific and medical questions, and thus scientific evidence offered to establish *Althen* prong one is viewed "not through the lens of the laboratorian, but instead from the vantage point of the Vaccine Act's preponderant evidence standard." *Id.* at 1380. Accordingly, special masters must take care not to increase the burden placed on petitioners in offering a scientific theory linking vaccine to injury. *Contreras v. Sec'y of Health & Human Servs.*, 121 Fed. Cl. 230, 245 (2015), *vacated on other grounds*, 844 F.3d 1363 (Fed. Cir. 2017).

In discussing the evidentiary standard applicable to the first *Althen* prong, many decisions of the Court of Federal Claims and Federal Circuit have emphasized that petitioners need only establish a causation theory's biologic plausibility (and thus need not do so with preponderant proof). *Tarsell v. United States*, 133 Fed. Cl. 782, 792–93 (2017) (special master committed legal error by requiring petitioner to establish first Althen prong by preponderance; that standard applied only to second prong and petitioner's overall burden); *Contreras*, 121 Fed. Cl. at 245 ("[p]lausibility . . . in many cases *may* be enough to satisfy *Althen* prong one" (emphasis in original)); *see also Andreu*, 569 F.3d at 1375. At the same time, there is contrary authority from the Federal Circuit suggesting that the preponderance standard applied when evaluating a claimant's overall success in a Vaccine Act claim also bears on the first *Althen* prong. *See, e.g.*, *Broekelschen v. Sec'y of Health & Human Servs.*, 618 F.3d 1339, 1350 (Fed. Cir. 2010) (affirming special master's determination that expert "had not provided a 'reliable medical or scientific explanation' *sufficient to prove by a preponderance of the evidence a medical theory* linking the [relevant vaccine to relevant injury]") (emphasis added). Regardless, one thing remains: petitioners always have the burden of establishing their Vaccine Act claim *overall* with preponderant evidence. *W.C. v. Sec'y of Health & Human Servs.*, 704 F.3d 1352, 1356 (Fed. Cir. 2013) (citations omitted); *Tarsell*, 133 Fed. Cl. at 793 (noting that *Moberly* "addresses the petitioner's overall burden of proving causation-in-fact under the Vaccine Act" by a preponderance).

The second *Althen* prong requires proof of a logical sequence of cause and effect, usually supported by facts derived from a petitioner's medical records. *Althen*, 418 F.3d at 1278; *Andreu*, 569 F.3d at 1375–77; *Capizzano*, 440 F.3d at 1326; *Grant v. Sec'y of Health & Human Servs.*, 956 F.2d 1144, 1148 (Fed. Cir. 1992). In establishing that a vaccine "did cause" injury, the opinions and views of the injured party's treating physicians are entitled to some weight. *Andreu*, 569 F.3d at 1367; *Capizzano*, 440 F.3d at 1326 ("medical records and medical opinion testimony are favored in vaccine cases, as treating physicians are likely to be in the best position to determine whether a 'logical sequence of cause and effect show[s] that the vaccination was the reason for the injury'")

(quoting *Althen*, 418 F.3d at 1280). Medical records are generally viewed as particularly trustworthy evidence, since they are created contemporaneously with the treatment of the patient. *Cucuras v. Sec'y of Health & Human Servs.*, 993 F.2d 1525, 1528 (Fed. Cir. 1993).

However, medical records and/or statements of a treating physician's views do not *per se* bind the special master to adopt the conclusions of such an individual, even if they must be considered and carefully evaluated. Section 13(b)(1) (providing that "[a]ny such diagnosis, conclusion, judgment, test result, report, or summary shall not be binding on the special master or court"); *Snyder v. Sec'y of Health & Human Servs.*, 88 Fed. Cl. 706, 746 n.67 (2009) ("there is nothing . . . that mandates that the testimony of a treating physician is sacrosanct—that it must be accepted in its entirety and cannot be rebutted"). As with expert testimony offered to establish a theory of causation, the opinions or diagnoses of treating physicians are only as trustworthy as the reasonableness of their suppositions or bases. The views of treating physicians should also be weighed against other, contrary evidence also present in the record—including conflicting opinions among such individuals. *Hibbard v. Sec'y of Health & Human Servs.*, 100 Fed. Cl. 742, 749 (2011) (not arbitrary or capricious for special master to weigh competing treating physicians' conclusions against each other), *aff'd*, 698 F.3d 1355 (Fed. Cir. 2012); *Caves v. Sec'y of Health & Human Servs.*, 100 Fed. Cl. 119, 136 (2011), *aff'd*, 463 F. App'x 932 (Fed. Cir. 2012); *Veryzer v. Sec'y of Health & Human Servs.*, No. 06-522V, 2011 WL 1935813, at *17 (Fed. Cl. Spec. Mstr. Apr. 29, 2011), *mot. for review denied*, 100 Fed. Cl. 344, 356 (2011), *aff'd without opinion*, 475 F. App'x 765 (Fed. Cir. 2012).

The third *Althen* prong requires establishing a "proximate temporal relationship" between the vaccination and the injury alleged. *Althen*, 418 F.3d at 1281. That term has been equated to the phrase "medically-acceptable temporal relationship." *Id.* A petitioner must offer "preponderant proof that the onset of symptoms occurred within a timeframe which, given the medical understanding of the disorder's etiology, it is medically acceptable to infer causation." *Bazan v. Sec'y of Health & Human Servs.*, 539 F.3d 1347, 1352 (Fed. Cir. 2008). The explanation for what is a medically acceptable timeframe must also coincide with the theory of how the relevant vaccine can cause an injury (*Althen* prong one's requirement). *Id*. at 1352; *Shapiro v. Sec'y of Health & Human Servs.*, 101 Fed. Cl. 532, 542 (2011), *recons. denied after remand*, 105 Fed. Cl. 353 (2012), *aff'd mem.*, 2013 WL 1896173 (Fed. Cir. 2013); *Koehn v. Sec'y of Health & Human Servs.*, No. 11-355V, 2013 WL 3214877 (Fed. Cl. Spec. Mstr. May 30, 2013), *mot. for review denied* (Fed. Cl. Dec. 3, 2013), *aff'd*, 773 F.3d 1239 (Fed. Cir. 2014).

B. *Law Governing Factual Determinations*

The process for making determinations in Vaccine Program cases regarding factual issues begins with consideration of the medical records. Section 11(c)(2). The special master is required to consider "all [] relevant medical and scientific evidence contained in the record," including "any

diagnosis, conclusion, medical judgment, or autopsy or coroner's report which is contained in the record regarding the nature, causation, and aggravation of the petitioner's illness, disability, injury, condition, or death," as well as "the results of any diagnostic or evaluative test which are contained in the record and the summaries and conclusions." Section 13(b)(1)(A). The special master is then required to weigh the evidence presented, including contemporaneous medical records and testimony. *See Burns v. Sec'y of Health & Human Servs*., 3 F.3d 415, 417 (Fed. Cir. 1993) (it is within the special master's discretion to determine whether to afford greater weight to contemporaneous medical records than to other evidence, such as oral testimony surrounding the events in question that was given at a later date, provided that such a determination is evidenced by a rational determination).

Medical records that are created contemporaneously with the events they describe are presumed to be accurate and "complete" (i.e., presenting all relevant information on a patient's health problems). *Cucuras*, 993 F.2d at 1528; *Doe/70 v. Sec'y of Health & Human Servs.*, 95 Fed. Cl. 598, 608 (2010) ("[g]iven the inconsistencies between petitioner's testimony and his contemporaneous medical records, the special master's decision to rely on petitioner's medical records was rational and consistent with applicable law"); *Rickett v. Sec'y of Health & Human Servs*., 468 F. App'x 952 (Fed. Cir. 2011) (non-precedential opinion). This presumption is based on the linked propositions that (i) sick people visit medical professionals; (ii) sick people honestly report their health problems to those professionals; and (iii) medical professionals record what they are told or observe when examining their patients in as accurate a manner as possible, so that they are aware of enough relevant facts to make appropriate treatment decisions. *Sanchez v. Sec'y of Health & Human Servs*., No. 11-685V, 2013 WL 1880825, at *2 (Fed. Cl. Spec. Mstr. Apr. 10, 2013); *Cucuras v. Sec'y of Health & Human Servs*., 26 Cl. Ct. 537, 543 (1992), *aff'd*, 993 F.2d 1525 (Fed. Cir. 1993) ("[i]t strains reason to conclude that petitioners would fail to accurately report the onset of their daughter's symptoms. It is equally unlikely that pediatric neurologists, who are trained in taking medical histories concerning the onset of neurologically significant symptoms, would consistently but erroneously report the onset of seizures a week after they in fact occurred").

Accordingly, if the medical records are clear, consistent, and complete, then they should be afforded substantial weight. *Lowrie v. Sec'y of Health & Human Servs*., No. 03-1585V, 2005 WL 6117475, at *20 (Fed. Cl. Spec. Mstr. Dec. 12, 2005). Indeed, contemporaneous medical records are generally found to be deserving of greater evidentiary weight than oral testimony—especially where such testimony conflicts with the record evidence. *Cucuras*, 993 F.2d at 1528; *see also Murphy v. Sec'y of Health & Human Servs.*, 23 Cl. Ct. 726, 733 (1991), *aff'd*, 968 F.2d 1226 (Fed. Cir.), *cert. denied sub nom. Murphy v. Sullivan*, 506 U.S. 974 (1992) (citing *United States v. United States Gypsum Co.*, 333 U.S. 364, 396 (1947) ("[i]t has generally been held that oral testimony which is in conflict with contemporaneous documents is entitled to little evidentiary weight")).

However, there are situations in which compelling oral testimony may be more persuasive than written records, such as where records are deemed to be incomplete or inaccurate. *Campbell v. Sec'y of Health & Human Servs*., 69 Fed. Cl. 775, 779 (2006) ("like any norm based upon common sense and experience, this rule should not be treated as an absolute and must yield where the factual predicates for its application are weak or lacking"); *Lowrie*, 2005 WL 6117475, at *19 ("[w]ritten records which are, themselves, inconsistent, should be accorded less deference than those which are internally consistent") (quoting *Murphy*, 23 Cl. Ct. at 733). Ultimately, a determination regarding a witness's credibility is needed when determining the weight that such testimony should be afforded. *Andreu*, 569 F.3d at 1379; *Bradley v. Sec'y of Health & Human Servs.*, 991 F.2d 1570, 1575 (Fed. Cir. 1993).

When witness testimony is offered to overcome the presumption of accuracy afforded to contemporaneous medical records, such testimony must be "consistent, clear, cogent, and compelling." *Sanchez*, 2013 WL 1880825, at *3 (citing *Blutstein v. Sec'y of Health & Human Servs*., No. 90-2808V, 1998 WL 408611, at *5 (Fed. Cl. Spec. Mstr. June 30, 1998)). In determining the accuracy and completeness of medical records, the Court of Federal Claims has listed four possible explanations for inconsistencies between contemporaneously created medical records and later testimony: (1) a person's failure to recount to the medical professional everything that happened during the relevant time period; (2) the medical professional's failure to document everything reported to her or him; (3) a person's faulty recollection of the events when presenting testimony; or (4) a person's purposeful recounting of symptoms that did not exist. *La Londe v. Sec'y Health & Human Servs*., 110 Fed. Cl. 184, 203–04 (2013), *aff'd*, 746 F.3d 1334 (Fed. Cir. 2014). In making a determination regarding whether to afford greater weight to contemporaneous medical records over contrary testimony, there must be evidence that this decision was the result of a rational determination. *Burns*, 3 F.3d at 417.

C. *Analysis of Expert Testimony*

Establishing a sound and reliable medical theory often requires a petitioner to present expert testimony in support of his claim. *Lampe v. Sec'y of Health & Human Servs.*, 219 F.3d 1357, 1361 (Fed. Cir. 2000). Vaccine Program expert testimony is usually evaluated according to the factors for analyzing scientific reliability set forth in *Daubert v. Merrell Dow Pharmaceuticals, Inc*., 509 U.S. 579, 594–96 (1993). *See Cedillo v. Sec'y of Health & Human Servs.*, 617 F.3d 1328, 1339 (Fed. Cir. 2010) (citing *Terran v. Sec'y of Health & Human Servs.*, 195 F.3d 1302, 1316 (Fed. Cir. 1999)). "The *Daubert* factors for analyzing the reliability of testimony are: (1) whether a theory or technique can be (and has been) tested; (2) whether the theory or technique has been subjected to peer review and publication; (3) whether there is a known or potential rate of error and whether there are standards for controlling the error; and (4) whether the theory or technique

enjoys general acceptance within a relevant scientific community." *Terran*, 195 F.3d at 1316 n.2 (citing *Daubert*, 509 U.S. at 592–95).

The *Daubert* factors play a slightly different role in Vaccine Program cases than they do when applied in other federal judicial fora (such as the district courts). *Daubert* factors are usually employed by judges (in the performance of their evidentiary gatekeeper roles) to exclude evidence that is unreliable and/or could confuse a jury. In Vaccine Program cases, by contrast, these factors are used in the *weighing* of the reliability of scientific evidence proffered. *Davis v. Sec'y of Health & Human Servs.*, 94 Fed. Cl. 53, 66–67 (2010) ("uniquely in this Circuit, the *Daubert* factors have been employed also as an acceptable evidentiary-gauging tool with respect to persuasiveness of expert testimony already admitted"). The flexible use of the *Daubert* factors to evaluate the persuasiveness and reliability of expert testimony has routinely been upheld. *See, e.g.*, *Snyder*, 88 Fed. Cl. at 742–45. In this matter (as in numerous other Vaccine Program cases), *Daubert* has not been employed at the threshold, to determine what evidence should be admitted, but instead to determine whether expert testimony offered is reliable and/or persuasive.

Respondent frequently offers one or more experts of his own in order to rebut a petitioner's case. Where both sides offer expert testimony, a special master's decision may be "based on the credibility of the experts and the relative persuasiveness of their competing theories." *Broekelschen*, 618 F.3d at 1347 (citing *Lampe*, 219 F.3d at 1362). However, nothing requires the acceptance of an expert's conclusion "connected to existing data only by the *ipse dixit* of the expert," especially if "there is simply too great an analytical gap between the data and the opinion proffered." *Snyder*, 88 Fed. Cl. at 743 (quoting *Gen. Elec. Co. v. Joiner*, 522 U.S. 146 (1997)); *see also Isaac v. Sec'y of Health & Human Servs.*, No. 08-601V, 2012 WL 3609993, at *17 (Fed. Cl. Spec. Mstr. July 30, 2012), *mot. for review denied*, 108 Fed. Cl. 743 (2013), *aff'd*, 540 F. App'x 999 (Fed. Cir. 2013) (citing *Cedillo*, 617 F.3d at 1339).

D. *Consideration of Medical Literature*

Both parties relied on significant amounts of medical and scientific literature to support their respective positions. I have reviewed all of the medical literature submitted in this case, although my decision does not discuss each filed article in detail. *Moriarty v. Sec'y of Health & Human Servs.*, 844 F.3d 1322, 1328 (Fed. Cir. 2016) ("[w]e generally presume that a special master considered the relevant record evidence even though he does not explicitly reference such evidence in his decision") (citation omitted).

ANALYSIS

I. DTaP Vaccine and Pertussis Toxin Contained Therein

Before considering whether Petitioner has met his evidentiary burden under *Althen*, I will briefly discuss case law pertaining to allegations that the pertussis toxin contained in certain vaccines can be causal of injury (since Petitioner's causation theory focuses in part on the contention that the DTaP vaccine precipitated L.Z.'s first seizures).

Past Vaccine Program decisions have rejected the notion that the residual amounts of inactivated/purified pertussis toxin present in the *acellular* pertussis vaccine can be considered to cause seizures or encephalopathy to a degree comparable to that of the whole cell version. *See, e.g.*, *Taylor v. Sec'y of Health & Human Servs*., 108 Fed. Cl. 807, 820 (2013) (noting that the modern DTaP vaccine was intended to minimize the amount of toxin in the vaccine as compared to past versions); *Murphy v. Sec'y of Health & Human Servs.*, No. 05-1063V, 2016 WL 3034047, at *12 (Fed. Cl. Spec. Mstr. Apr. 25, 2016), *mot. for review denied*, 128 Fed. Cl. 348 (2016); *James v. Sec'y of Health & Human Servs*., No. 09–284V, 2010 WL 4205699, at *11 (Fed. Cl. Spec. Mstr. Sept. 30, 2010) (acellular form of the pertussis vaccine is much less toxic than the whole-cell form).

As such decisions reveal, older medical literature establishing that amounts of toxin contained in versions of the vaccine previously administered are sufficient to be associated with seizures or other neurologic injuries cannot be applied wholesale to the version of the vaccine currently administered. *Snyder v. Sec'y of Health & Human Servs.*, No. 07-59V, 2011 WL 3022544, at *30 (Fed. Cl. Spec. Mstr. May 27, 2011) (explaining that applying DTP-related risk data to DTaP is a "problematic" and misleading extrapolation); *see also Sharpe v. Sec'y of Health & Human Servs.*, No. 14-65V, 2018 WL 7625360, at *32 (Fed. Cl. Spec. Mstr. Nov. 5, 2018). Such claims thus often founder on a petitioner's inability to establish that the amount of pertussis toxin that may remain in the acellular form of the vaccine is sufficient to provoke neurologic injury. *Murphy*, 2016 WL 3034047, at *12, 33. I keep these sound determinations in mind in assessing the strength of Petitioner's evidentiary showing.

II. Petitioner Has Not Met His Evidentiary Burden of Proof

I address the *Althen* prongs relevant and dispositive herein, in order of their significance to my determination.[21]

[21] Because Petitioner's claim fails on the first two *Althen* prongs, I do not include an extended discussion of the third—since absent a reliable and persuasive theory of causation, satisfaction of this *Althen* prong (which considers the timeframe in which a vaccine is alleged to have caused injury) is an insufficient basis for an entitlement award. *Caves v. Sec'y of Health & Human Servs.*, No. 07-443, 2010 WL 5557542, at *21–22 (Fed. Cl. Spec. Mstr. Nov. 29, 2010), *mot. for review denied*, 100 Fed. Cl. 119 (2011), *aff'd*, 463 F. App'x 932 (Fed. Cir. 2012). But Petitioner did not succeed in satisfying this prong either. Although the eight-day period from vaccination to onset of L.Z.'s seizure

A. *Althen* Prong One

After careful review of the various theories outlined by Dr. Steinman and the evidence he cites in support for those theories, I find that Petitioner has failed to offer a medically and scientifically reliable theory for how any of the vaccines L.Z. received could have caused a seizure disorder.

1. *Pertussis Toxin*

The most credible of Petitioner's proffered theories pertained to the DTaP vaccine. Dr. Steinman opined that small amounts of the pertussis toxin remaining in the DTaP vaccine could cause seizures. Steinman Rep. at 6–7; Tr. at 87–98. But this theory relied on a series of suppositions, not all of which were supported by the filed medical literature or clearly set forth in persuasive expert testimony.

First, Dr. Steinman asserted that the acellular pertussis vaccine still contains *some* amount of the pertussis toxin. Steinman Rep. at 6 (citing Gomez). Reliable literature supports this statement. *See* Gomez at 3311 (noting that "some residual [pertussis toxin] activity may likely be present" in DTaP "because of the limitations of the detoxification processes used"). However, Petitioner did not establish *what* levels of residual toxin would be sufficient to cause injury, or that the amount found in a DTaP vaccine are of that level, instead assuming instead that *any* amount would be enough. The fact that larger amounts contained in the whole cell version of the vaccine may previously have been determined to be associated with injury does not mean that a version of the vaccine intended to reduce, if not eliminate, that risk is equally problematic. *See, e.g.*, *Murphy*, 2016 WL 3034047, at *12. And articles like Gomez say nothing at all about what levels of residual pertussis toxin are problematic. *Gomez* at 3312 (purpose of study was to propose more effective and humane test for determining presence of pertussis toxin).

Second, Petitioner proposed that the pertussis toxin is associated with an enzymatic process (ADP-ribosylation). Steinman Rep. at 6. At hearing, however, Dr. Steinman conceded that much of the literature offered in support of such contentions was outdated. *See* Steinman Rep. at 6, 9;

disorder is facially reasonable, and consistent with other cases in which vaccines have been found to cause neurologic harm, Petitioner's specific explanation for why such a timeframe was medically reasonable in *this* case was unpersuasive. Articles like Gomez (which Dr. Steinman discussed at hearing as supporting a seven- to eight-day post-vaccination onset) did not actually measure the timeframe in which the pertussis toxin component of a DTaP vaccine would begin to cause seizures (assuming it could do so in the miniscule amounts contained therein). Instead, the timeframe Dr. Steinman relied on from Gomez related solely to when the HIST process produced mice death *after* an intervening factor (histamine challenge). That factor (which is introduced specifically to measure toxin amounts in a vaccine) has no bearing on how long the pertussis toxin would take *by itself* to cause neurologic injury, where an individual received a DTaP vaccine under normal circumstances.

Tr. at 118–19. The more recent literature Petitioner filed was not itself that persuasive for the larger point it was intended to bulwark. Thus, although Gomez (published in 2007) did somewhat support Dr. Steinman's argument, there were limitations to its findings that reduce its overall probative value. *See* Gomez at 3317 (noting that pertussis toxin levels for chemically-detoxified DTaP could *not* be measured well via ADP-ribosylation enzyme activity).

Ultimately, however, Dr. Steinman's theory fails in its most central contention: that "excessive ADP ribosylation can [. . .] play a neuropathic role leading to seizures and to neuronal death." Steinman Rep. at 6. Articles like Gomez do not stand for this proposition; on the contrary, Gomez showed *lower* ADP-ribosylase enzymatic activity levels in whole cell pertussis than in seven of the eight acellular varieties tested, despite the fact that whole cell pertussis contains *more* toxin than any detoxified pertussis variety, and has been otherwise more credibly associated with neurologic damage than the acellular version. Gomez at 3314–15 (finding that "the residual [pertussis toxin] enzymatic activity in [whole cell DTP] was found to be much lower in comparison to DTaP products, with the exception of [one DTaP variety]"). Other items of literature cited do not support the concept that this enzymatic process is harmful, but instead involved experiments in which seizures were *already* ongoing or had been induced in some other manner. *See* Wang at 1285, 1288 (seizures triggered by kainic acid); Chi at 284 (discussing observations relating to ongoing seizures). Thus, the fact that ADP-ribosylation (or PARP, which Dr. Steinman posited, without much evidentiary support, was comparable) occurred concurrently with seizures did not necessarily mean that ADP-ribosylation was responsible for the seizure activity itself. *See id.* Dr. Steinman otherwise did not demonstrate that any research he performed in the past relating to pertussis toxin and the means by which it might be theoretically understood to cause seizure has been confirmed or corroborated in the past ten years (or longer)—especially in light of the present-day, widespread use of the acellular version of the vaccine.[22]

2. *RotaTeq and Hib*

The other proposed means by which the vaccines L.Z. received could have caused his seizures had even less reliable scientific support than Petitioner's DTaP theory. Thus, to substantiate his contention that the RotaTeq or Hib vaccines could have caused L.Z.'s seizures, Dr. Steinman relied almost exclusively on their respective package inserts. Steinman Rep. at 5–6; Tr. at 81–83. Yet—as Dr. Steinman effectively conceded—the relevant package insert data did *not* strongly support his conclusion. The RotaTeq package insert data showing an increased seizure

[22] I also give some weight to Dr. Zempel's assessment of the persuasiveness of the ADP-ribosylation theory, which he deemed insufficiently specific and coherent to discuss in depth. *See* Tr. at 169; Zempel Rep. at 10. However, because Dr. Zempel did not possess the same level of expertise in immunologic issues as Dr. Steinman, my determinations on the success of Petitioner's *Althen* prong one showing related less to Dr. Zempel's rebuttal and more to Petitioner's ultimate inability (consistent with his burden) to satisfy this prong with preponderant proof arising from reliable scientific and medical evidence.

incidence is not statistically significant. Tr. at 83–83; Ex. 33 at 6 (noting that "seizures reported as serious adverse experiences occurred in <0.1% (27/36,150) of vaccine and <0.1% (18/35,536) of placebo recipients (not significant)"). With regard to Hib, the package insert merely discussed a study of over five thousand infants in which "two definite and three possible seizures" were noted after receiving a Hib vaccine concurrently with a DTP vaccine, but concluded that *no* cause and effect relationship has been established between the Hib vaccine and seizure. Ex. 34 at 18–19, filed Aug. 2, 2017 (ECF No. 25-7).[23] And even if the data listed on either package insert showed a stronger association with seizures, package inserts are generally afforded very little weight in Vaccine Program cases as proof of causation. *See, e.g.*, *Christiansen v. Sec'y of Health & Human Servs.*, No. 08-244V, 2012 WL 6766650, at *12 (Fed. Cl. Spec. Mstr. Nov. 13, 2012).

3. *Alum Adjuvant*

Dr. Steinman's argument that the alum adjuvant in DTaP may have played a role in causing L.Z.'s seizures was equally deficient. *See* Steinman Rep. at 7; Tr. at 98–99. This contention was supported with almost no reliable medical literature, beyond one item speaking only generally to the relationship between the immune system and the central nervous system. *See generally* R. Bhat & L. Steinman, *Innate and Adaptive Autoimmunity Directed to the Central Nervous System*, 64 Neuron 123 (2009), filed as Ex. 46, Sept. 6, 2018 (ECF No. 51-9). And I have regularly found generalized theories about the purported pathogenic role of adjuvants unpersuasive in past Vaccine Program decisions, absent proof specific to the injury in question or relevant vaccine. *See, e.g.*, *Johnson v. Sec'y of Health & Human Servs.*, No, 10-578V, 2016 WL 4917548, at *8–9 (Fed. Cl. Spec. Mstr. Aug. 18, 2016). The fact that vaccines are known to stimulate cytokine production (in part due in some cases to the inclusion of an adjuvant) does not amount to a reliable causation theory that such stimulation is necessarily disease-causing.

Given the above, I cannot find Petitioner's proffered causation theories were sufficiently reliable and persuasive to satisfy *Althen* prong one.

B. *Althen* Prong Two

Although Petitioner did not establish a reliable and persuasive causation theory with sufficient preponderant evidence, his claim would still be unsuccessful even were this not the case, because the record evidence does not support the conclusion (under the second, "did cause," *Althen*

[23] In his written report, Dr. Steinman includes a quote purportedly taken from the Hib package insert that states: "In Study P3T06, within 30 days following any of Doses 1–3 of DAPTACEL + IPOL + ActHIB 10 vaccines, 50 of 1,455 (3.4%) participants experienced a serious adverse event. One SAE of 11 seizure with apnea occurring on the day of vaccination with the first dose of the three vaccines 12 was determined by the investigators as possibly related." Steinman Rep. at 6. This language does not appear in the document filed as the Hib package insert, however (Ex. 34), and I do not find the quoted excerpt otherwise clearly demonstrative of an association between the Hib vaccine and seizures.

prong) that the vaccines L.Z. received on March 24, 2014 likely caused his seizure disorder beginning on April 1st, approximately eight days later.

Overall, there are too many factual gaps in the medical record to discern an association between L.Z.'s vaccinations and his seizures (especially given the sequence of events in this case). Thus, although seizures can be triggered by a vaccine-induced fever,[24] L.Z. unquestionably did not experience a fever in conjunction with the vaccinations or the first onset of his seizures over a week later—thereby reducing the likelihood that he was at that time experiencing an underlying inflammatory event. Ex. 22 at 2522. Indeed, there is no record evidence suggesting that L.Z. experienced any reaction at all between the March 24th vaccinations and his initial seizures. And, as explained persuasively by Dr. Zempel, the difference between L.Z.'s MRI reading in April (which was normal) and May 2014 (which showed substantial brain volume loss) is most likely attributable to damage caused by refractory status epilepticus seizure activity—not vaccine-mediated inflammation. Zempel Rep. at 9; Ex. 11 at 47.

No other testing from L.Z.'s initial hospitalization would confirm Petitioner's theory, beyond the evidence of pleocytosis based on CSF measurements taken after his April 2nd hospitalization. This test result does establish central nervous system inflammation, but it was obtained only *after* onset of his seizures. Such a temporal sequence makes it difficult to find it more likely than not that L.Z. was at that time experiencing a vaccine-caused inflammatory process (especially since, as the second CSF reading indicated, the pleocytosis appeared ultimately to be somewhat transient).

Respondent did propose that L.Z.'s seizures could be associated with preexisting developmental problems, but the medical record is inconclusive on this point. The unrebutted evidence of L.Z.'s developmental problems was piecemeal in nature, and its overall probative value reduced by Dr. Zempel's concessions that he could not conclude from it that L.Z. was at high risk for onset of seizures. *See, e.g.*, Ex. 3 at 61–66; Tr. at 211–12. The fact that L.Z. was referred for developmental services around the time of his vaccinations has not been shown to be more than temporally coincidental with his seizures (akin to my finding in this case that L.Z.'s post-vaccination seizures temporally coincided with vaccination). At most, this category of evidence provided weak weight against Petitione—not enough to tilt the scale against his claim on its own, but unhelpful to Petitioner given other, more persuasive evidence discussed above.

Admittedly, Petitioner offered the testimony of one treater, Dr. Siegler, who opined that L.Z.'s seizures were likely vaccine-caused based on his direct experience with L.Z. Dr. Siegler was largely a credible witness, who appears to have testified truthfully about his observations in

[24] Vaccine Program precedent recognizes that vaccination may trigger a fever, which in turn can trigger seizures. *See, e.g., Tembenis v. Sec'y of Health & Human Servs.*, No. 03-2820V, 2010 WL 5164324, at *15–16 (Fed. Cl. Spec. Mstr. Nov. 29, 2010).

treating L.Z., based on his firsthand knowledge of L.Z.'s medical history. It is well-established that treater statements have strong probative value—although special masters are not bound by a treater's views. *See* Section 13(b)(1); *Snyder*, 88 Fed. Cl. at 746 n.67. Dr. Siegler's testimony is accordingly entitled to some deference, and it certainly supports Petitioner's "did cause" contentions.

However, several factors lead me to give Dr. Siegler's testimony less weight than what Petitioner might urge. First, no contemporaneous treater *other* than Dr. Siegler seems to have considered L.Z.'s seizures to have been vaccine-caused.[25] Second, Dr. Siegler's causality views only came into focus in September of 2016—two and a half years after the first onset of L.Z.'s seizures, and after this petition was filed. Only then did Dr. Siegler file a VAERS report. While Dr. Siegler maintained at hearing that in the interim period he had attempted to eliminate other, more likely causes before considering the possibility of vaccine causation, it is well-established in the Vaccine Program that contemporaneous medical records—including treater opinions about possible etiologies—are given more weight than later-in-time statements to the contrary. *See Burns*, 3 F.3d at 417. Here, those contemporaneous records memorialize Dr. Siegler's view in 2014 that Petitioner's etiology was unlikely to ever be determined. *Compare* Ex. 11 at 38 *with* Tr. at 48–49, 56. Dr. Siegler's subsequent opinion that L.Z.'s vaccinations produced his seizures loses some of its probative weight when considered in light of the full medical record (although I also acknowledge his statement that he revised his opinion only after other etiologies had been rejected).

At the same time, Dr. Zempel's testimony about seizure etiology *was* probative and significant. Dr. Zempel persuasively established, based on his extensive experience treating comparable pediatric patients, that the causes of pediatric seizure disorders often remain unknown, and that the specific facts of this case did not lead him to consider L.Z.'s vaccines as causal. Zempel Rep. at 10–11. Although in this case many possible explanations, from an identified viral infection to an underlying genetic cause, were ruled out, a Vaccine Program petitioner does not succeed in his claim simply by eliminating other possible causes. *Althen*, 418 F.3d at 1278; *Thomas v. Sec'y of Health & Human Servs.*, No. 01-645V, 2007 WL 470410, at *25 (Fed. Cl. Spec. Mstr. Jan. 23, 2007) (citing *Grant*, 956 F.2d at 1149). Rather, a petitioner must affirmatively, and preponderantly, establish that the *specific vaccine received* (whether alone or in series with others) was the cause of the relevant injury. On the basis of this record, the only conclusion I can reach is that L.Z.'s seizures were most likely idiopathic. *See Bazan*, 539 F.3d at 1353 (special master's finding that a petitioner's injury was not vaccine-caused implied that the injury had some other cause, but did not impermissibly heighten petitioner's burden of proof by requiring petitioner to *eliminate* alternative causes).

[25] In this regard, I take some pause at Dr. Siegler's relationship to counsel in this case, and the possibility that his opinion arose out of a desire to support the litigation (*see* n.13, above). I have nevertheless given careful consideration to his testimony, and ultimately give it less weight solely due to factors relevant to the medical record, rather than to the connection between witness and counsel.

At bottom, Petitioner relied heavily on the eight-day temporal proximity between vaccination and seizure onset. Indeed, Dr. Siegler characterized this as persuasive proof. Tr. at 56. But temporal association alone does not suffice to demonstrate causation in the Vaccine Program. *McCarren v. Sec'y of Health & Human Servs.*, 40 Fed. Cl. 142, 147 (1997). As explained by Dr. Zempel, "[c]ases of catastrophic epilepsy occur throughout infancy and childhood and will obviously in some cases have temporal overlap with the timing of vaccination." Zempel Rep. at 10. While it is clear from the record that L.Z.'s condition changed dramatically and irrevocably soon after vaccination, this sequence alone is not enough grounds to conclude that his seizures were likely the *result* of the vaccines.

CONCLUSION

L.Z.'s case is tragic, and Petitioner's moving testimony made clear that both L.Z. and his family have been deeply and irrevocably affected by his seizure disorder. In a case such as this—where a child unquestionably possesses a severe illness, and where the testifying witnesses were sincere and credible—it is very difficult to resist awarding a petitioner damages. But I am required to apply the law of the Vaccine Program correctly, rather than based upon my personal sympathies, and such an application to this case does not lead me to conclude that preponderant evidence supports Petitioner's cause of action. I therefore DENY entitlement in this case.

In the absence of a timely-filed motion for review (see Appendix B to the Rules of the Court), the Clerk shall enter judgment in accord with this decision.[26]

IT IS SO ORDERED.

/s/ Brian H. Corcoran
Brian H. Corcoran
Special Master

[26] Pursuant to Vaccine Rule 11(a), the parties may expedite entry of judgment by filing a joint notice renouncing their right to seek review.